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WILD TURKEY INVESTIGATIONS AND MANAGEMENT RECOMMENDATIONS FOR THE BILL WILLIAMS MOUNTAIN AREA

Fred Phillips

WILD TURKEY INVESTIGATIONS AND MANAGEMENT RECOMMENDATIONS FOR THE BILL WILLIAMS MOUNTAIN AREA

by

Fred Phillips

Arizona Game and Fish Department

1982

This publication was prepared and printed under the provisions of a contract (order number 43-8371-0-693) between the U.S. Forest Service, Region 3, Albuquerque, N.M., and the Arizona Game and Fish Department.

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PREFACE

This publication, as funded under U.S. Forest Service contract, called for documenting my studies and personal knowledge of the Merriam turkey and its specific habitat requirements in northern Arizona. Written as a "working paper," this publication presents all the data I have in a first effort towards development of a satisfactory habitat and hunting management plan for Merriam turkey. I prefer to look upon the text that follows as a compilation of findings and, in some instances, personal impressions, which were derived from 12 years of field experience with this great game bird. I recognize that some of the data are soft, but I hope this will attract the attention of other researchers who can implement more intensive studies in these areas.

Fred Phillips
March 1982

ACKNOWLEDGMENTS

I wish to thank the employees of the Kaibab National Forest and the Arizona Game and Fish Department, whose cooperation, assistance, and encouragement made this project possible. In particular, I would like to express my appreciation to:

Harley Shaw (AGFD), who furnished traps, tagging materials, and advice at the onset of the study.

Ron Burraychak (USFS), who assisted with trapping and tagging during the first years of the project.

Jerry Davis (USFS), for help with trapping and tagging and the constant reminders of the need for habitat recommendations to his agency.

Gary Halbert, of Williams, Arizona, who as a young teenager spent most of his weekends and winter vacations helping catch turkeys.

Dave German (USFS), for data on past logging history, and Dan Baertlein (USFS), for information on roads within the study area.

Ron Smith (AGFD), for obtaining tagging material and for the computer plotting of marked bird observations.

Ron Engel-Wilson (AGFD), for help in trying to analyze the data.

Levi Packard (AGFD), my Regional Supervisor, for his tolerant attitude.

Bill Zeedyk (USFS), Dave Patten (USFS), Steve Lucas (USFS), Tom Britt (AGFD), and Dave Brown (AGFD), for reviewing and commenting on the manuscript.

Marge Maston and Norma Sankey (AGFD), for typing.

Matt Alderson (AGFD), for preparing maps and graphs.

Clay Baxter (USFS), for his cooperation, help, advice, and information during all phases of this study.

Paul Webb (AGFD), for his counsel, advice, and assistance throughout the study.

I am especially indebted to Glen C. Christensen for his editorial assistance in organizing and preparing the manuscript.

INTRODUCTION

The Merriam turkey (Meleagris gallopavo merriami) is the third-ranked big game animal, in terms of hunter participation, in Arizona. The sounds of a gobbler on a cool, crisp spring morning, or the soft yelp of a hen coaxing young poults into cover, have been and always should be a part of man's experience in Arizona's mountain forests.

Basic wild turkey investigations were made in Arizona and adjacent states in the late 1940s and early 1950s, and these were followed by intermittent specific research studies. There has been no sustained effort since the early 1970s to document the rapidly increasing impacts that have occurred in turkey habitat and to evaluate these impacts with past and present turkey harvest management schemes.

A wild turkey study was conducted in the Bill Williams Mountain Area (Management Unit 8), in northcentral Arizona, during the period of 1971 through 1975 to provide a better understanding of land-use practices and the demands on turkey populations and their habitats. This study was a cooperative effort, with the Arizona Game and Fish Department funding the basic study and the U.S. Forest Service funding publication costs. The objectives of this study were:

1. To determine the basic habitat needs of turkey populations so management recommendations can be made to the proper land management agency.

2. To develop a hunting framework directed toward allowing maximum hunter participation consistent with annual turkey populations.

DESCRIPTION OF STUDY AREA

Location

The study area (Fig. 1) is located in the Kaibab National Forest south of Williams, Arizona, and is identified as Wildlife Management Unit 8 for purposes of administration by the Arizona Game and Fish Department. Bill Williams Mountain is the most prominent landmark in the unit. The unit encompasses 276 square miles of turkey habitat and represents the western limits of contiguous turkey range in Arizona.

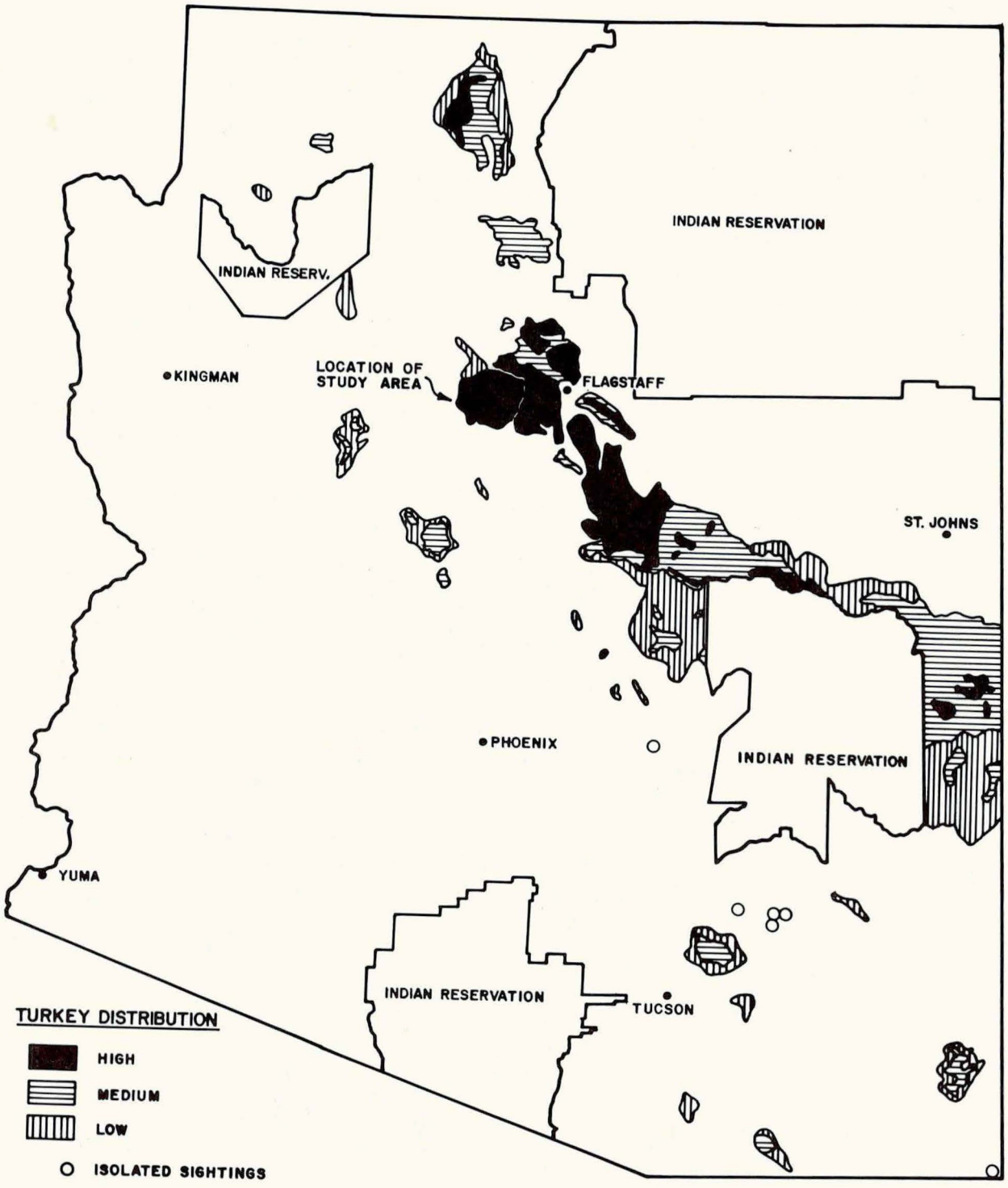

Fig. 1. Location of study area.

Topography

The study area is divided by Hell Canyon in the west, M. C. Canyon in the southwest, and Government, Tule, and Sycamore Canyons in the southeast and east. These canyons are small in the upper reaches but become steep and broken where they pass through the Mogollon Rim. Elevations range from 5,800 feet at the south and southwestern extremities of turkey range to 9,286 feet at the summit of Bill Williams Mountain.

Soils*

The major geologic substratum is igneous of extrusive origin. Bill Williams Mountain is comprised of andesite, ryolite, and basalt of the late Tertiary period. Otherwise, basalt of both the Quaternary and Tertiary periods dominates the landscape above the Mogollon Rim. Basins and alluvial deposits within this area are small.

The soil order Alfisols occurs over most of the study area wherever ponderosa pine (Pinus ponderosa) and Gambel oak (Quercus gambelii) are dominant. The alluvial bottoms and small basins where the ponderosa pine-grassland and isolated stands of aspen (Populus tremuloides) occur are of the soil order Mollisols. In the transition area from ponderosa pine-Gambel oak to pinyon-juniper, the larger areas of pinyon-juniper occur on soils of the order Vertisols. Limited areas of mixed conifer that occur on the north and northeastern slopes, primarily on Bill Williams Mountain, are on soils of the order Inceptisols.

Vegetation

Vegetation on the study area is principally Petran Montane Coniferous Forest (Brown and Lowe 1974) and is composed of four major associations that make up 95% of the cover of the area (Fig. 2 and Table 1). The ponderosa pine-Gambel oak association comprises 50.5% of the total; pure ponderosa pine occupies 33.2%. The other communities are ponderosa pine-grassland (6%) and pinyon-juniper woodland (5.3%).

In the lower transition areas of pine-oak and pinyon-juniper, limited amounts of chaparral and grassland occur. The pinyon-juniper woodland is composed principally of Utah juniper (Juniperus osteosperma) and alligator juniper (J. deppeana); pinyon (Pinus edulis) is sparse.

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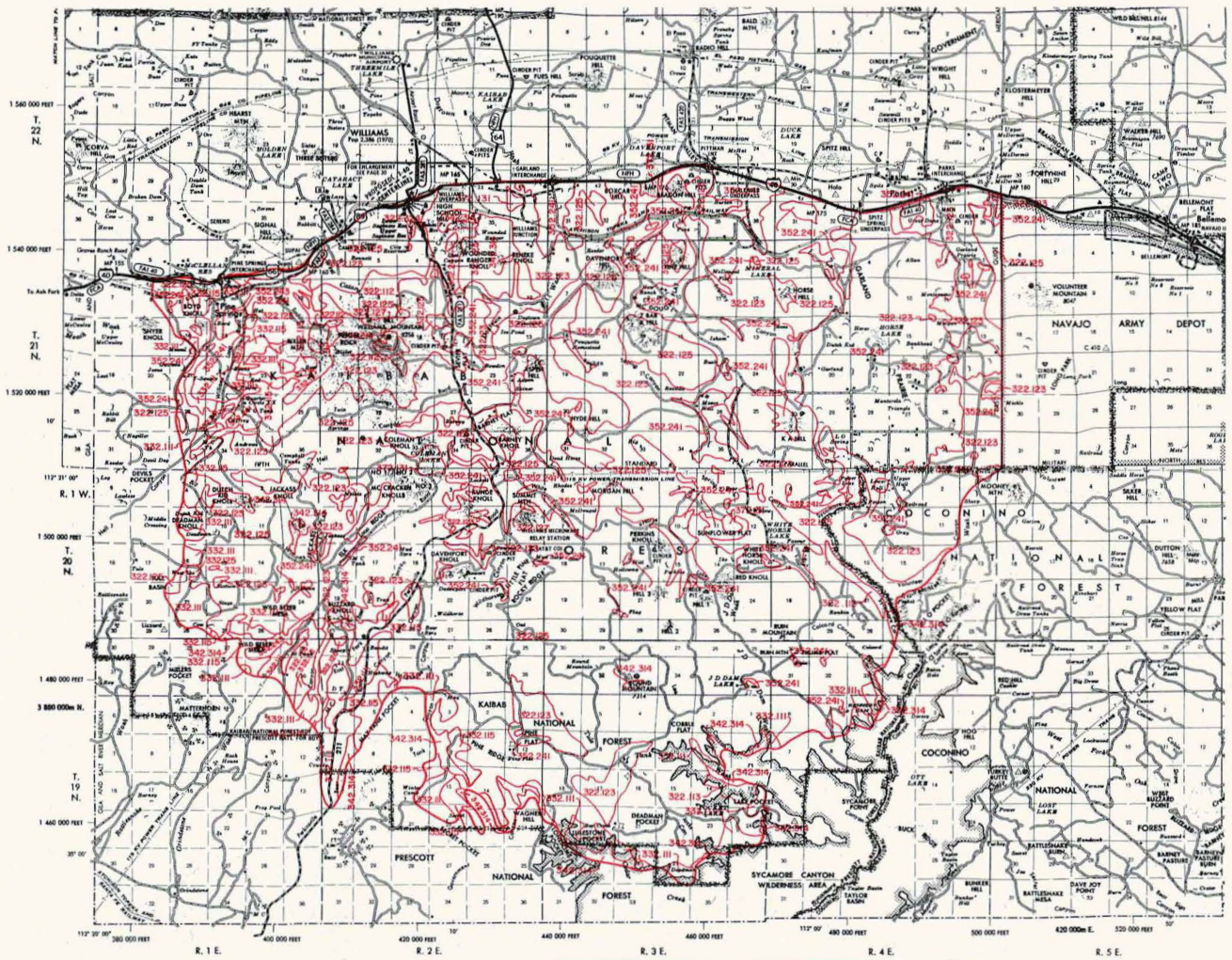
*Soils information from Ron Brewer, Soils Scientist, Kaibab National Forest, Arizona.



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SCALE

STATUTE MILES

TRANSVERSE MERCATOR PROJECTION, ARIZONA CENTRAL ZONE
COMPILED BY PHOTOGRAMMETRIC METHODS
1927 NORTH AMERICAN DATUM
CONTROL BY U. S. COAST AND GEODETIC SURVEY, U. S. GEOLOGICAL SURVEY
U. S. FOREST SERVICE AND BUREAU OF LAND MANAGEMENT
INVENTORY 1966

VEGETATION OF THE STUDY AREA

CLASSIFICATION[a]	SPECIES ASSOCIATION
322.112	DOUGLAS FIR-WHITE FIR
322.113	WHITE FIR-DOUGLAS FIR-PONDEROSA PINE
322.127	ASPEN
322.123	PONDEROSA PINE
322.125	PONDEROSA PINE-GAMBEL OAK
332.111	PINYON-JUNIPER
332.115	JUNIPER-PINYON-CHAPARRAL ECOTONE
342.314	TURBINELLA OAK
352.241	MIXED GRASS-(PONDEROSA PINE)
352.243	MIXED GRASS-(PINYON-JUNIPER)

[a] BROWN & LOWE, 1974

Fig. 2. Vegetation in study area.

Table 1

Vegetation of Study Area

Classification[a]	Species Association	Acres	% of Total
322.112	Douglas fir-white fir	1,400	0.8
322.113	White fir-Douglas fir-ponderosa pine	960	0.5
322.127	Aspen	280	0.2
322.123	Ponderosa pine	58,500	33.2
322.125	Ponderosa pine-Gambel oak	89,140	50.5
332.111	Pinyon-juniper	9,360	5.3
332.115	Juniper-pinyon-chaparral ecotone	3,040	1.7
342.314	Turbinella oak	2,420	1.4
352.241	Mixed grass-(ponderosa pine)	10,620	6.0
352.243	Mixed grass-(pinyon-juniper)	680	0.4
	Total	176,400	100.0

[a]Brown and Lowe (1974).

At the highest elevations Douglas fir (Pseudotsuga taxifolia), white fir (Abies concolor), and aspen are found.

Climate

A number of different air masses influence the study area. The winter months are dominated by cool, moist air which moves in from the Pacific Ocean; but there are also times when cold, dry, continental air, originating in Canada, can result in freezing winter conditions. On the other hand, summer precipitation is often the result of warm tropical storms generated in Mexico or from tropical storms that move northwestward out of the Gulf of Mexico. During the late summer months, some influence may be exerted by moist tropical air from the Pacific.

Precipitation

Average annual precipitation at Williams, Arizona, is 21.21 inches. Recorded extremes are from 12.28 inches in 1956 to 39.93 inches in 1965. Fig. 3 presents the monthly mean. Winter snowfall for the average year is 80 inches, and the recorded extremes were 24.0 inches and 146.4 inches.

Temperatures

The maximum and minimum temperatures recorded at Williams, Arizona, over a 41-year period were 100°F in June 1970 and -25°F in January 1937. The mean annual temperature at this station is 49.7°F over a 30-year period. Mean monthly temperature data are presented in Fig. 4.

Water

Man-made earthen stock tanks provide most of the water found in the study area. Natural and developed springs and rock potholes augment the stock waters. In over 81% of the study area a dependable water source, except for drought years, can be found within one mile of any location.

MAJOR LAND USES

Land Ownership

The wild turkey habitat in Management Unit 8 is comprised of 95.5% public land and 4.5% private land. Of the 7,960 acres of private land, 13.8% has been or is in the process of being developed for residences and commercial properties. This has resulted in the loss of good turkey

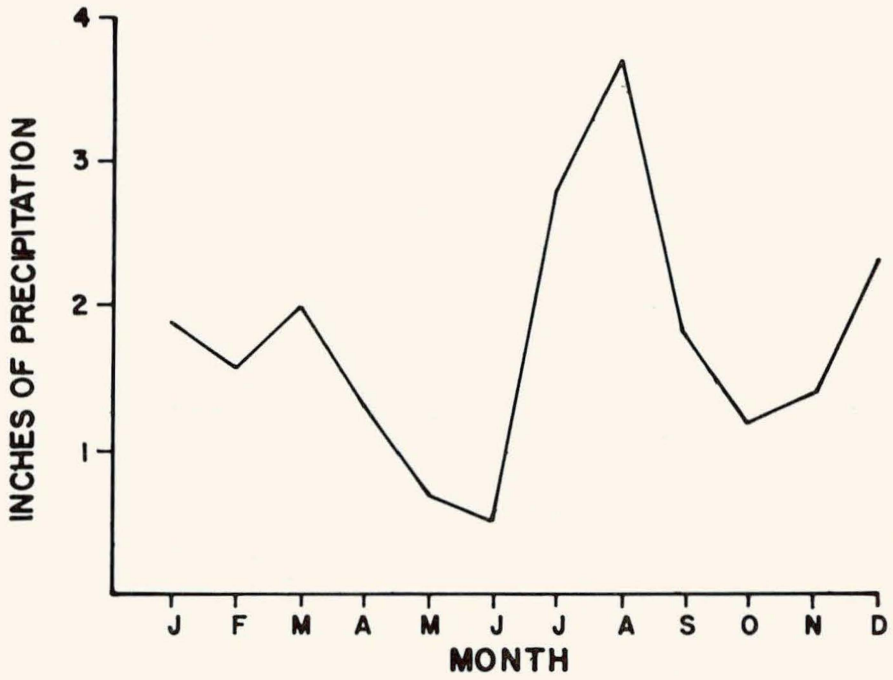

Fig. 3. Monthly mean precipitation at Williams, Arizona, 1941-1970 (Sellers and Hill 1974).

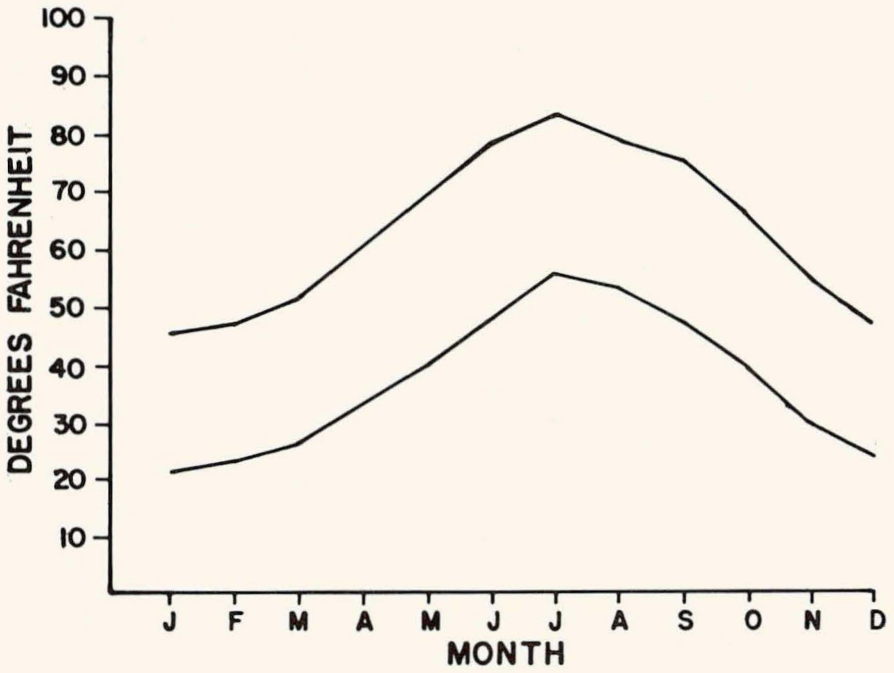

Fig. 4. Monthly mean temperatures at Williams, Arizona, 1941-1970 (Sellers and Hill 1974.)

range. The remaining acreage is in small tracts of 40 to 160 acres and has the potential for future commercial and residential development.

Timber

The study area has been heavily logged in the past and is presently under intensive timber management. All phases of timber management (precommercial thinning, saw timber harvest, pulpwood harvest, and reforestation) are practiced (Tables 2, 3, and 4).

In the early 1900s, the study area was dominated by extensive virgin stands of ponderosa pine. Natural burns removed the less fire resistant trees and shrubs and resulted in creating openings among the mature pines and encouraged successional vegetation to thrive. The result was a park-like appearance which provided all of the habitat components, when near water, needed to succor turkey populations. The turkeys fed on the grasses, forbs, and mast crops generated on the burned areas; utilized the thicker patches of oaks and pinyon-juniper for cover; and were able to roost high and safely in large mature ponderosa pines at night.

Logging practices from 1902 through the 1950s were to change this aspect. Most of the early timber harvest was based on "seed cuts," a practice whereby large areas were clear cut, leaving only a few trees per acre for regeneration. The 1935 sale of 103.8 million board feet (Table 2) was significant, because it probably resulted in the removal of most virgin stands of ponderosa pine over the contract period. The dramatic effect is observable today.

At the present time (1982), it is no longer possible to meet the harvest objectives with mature and over-mature ponderosa pine, and it is necessary to cut intermediate classes. The current practices of harvesting saw timber and pulpwood, in conjunction with fire control and thinning, have resulted in the creation of stands of ponderosa pines having even aged trees within the stand but with a variation in age classes between stands. Mature and over-mature trees make up the smallest percentage of the age classes present, and harvest practices are designed to continue removing these on a selective basis with no provision to allow for maturation of trees. With the loss of mature pines, the pinyon-juniper association has expanded, grasses and forbs have decreased (complicated by grazing pressures), the parklike appearance is essentially gone, and suitable turkey roost sites are limited.

Table 2

Saw Timber Harvest in Management Unit 8

Year	Timber Sold (million board feet)	Year	Actual Cut (million board feet)
Prior to 1902	0.3	1957	2.5
		1958	5.4
		1959	5.0
1920	0.5	1960	3.3
1923	0.6	1961	5.3
1924	25.9	1962	8.4
1925	0.2	1963	0.0
1926	1.5	1964	9.1
1927	3.5	1965	5.5
1928	20.0	1966	1.1
1929	4.8	1967	5.8
1930	2.0	1968	1.4
1931	0.1	1969	2.3
1935	103.8	1970	4.4
1936	0.3	1971	0.6
1937	6.0	1972	3.0
1939	0.6	1973	11.6
1940	0.1	1974	6.7
1941	5.7	1975	4.7
1950	1.4	1976	2.8
1951	0.1	1977	3.0
1953	0.3	1978	2.7
1954	4.2	1979	3.2
1955	2.7	1980	1.9

Note. There were no recorded cuts from 1902 to 1919 and no sales from 1942 to 1949.

Table 3

Pulpwood Harvest in Management Unit 8

Year	Actual Cut (cords)
1963	12,000
1964	5,000
1965	5,000
1966	4,000
1967	10,000
1968	11,000
1969	8,000
1970	10,000
1971	6,000
1972	5,000
1973	3,000
1974	4,000
1975	6,000
1976	3,000
1977	6,000
1978	6,000
1979	7,000
1980	6,000

Note. From 1963 to 1979, cuts made to a general stocking level of 80 sq. ft. per acre. In the winter of 1980-81, the general stocking level was changed to 60 sq. ft. per acre.

Table 4

Precommercial Thinning in the South Chandler and Williams Districts

Fiscal Year	Acres[a]
1969	500 est.
1970	500 est.
1971	2,000 est.
1972	2,800
1973	3,000
1974	3,000
1975	4,800
1976	2,500
1977	4,700
1978	3,500
1979	3,200
1980	3,500
1981	4,300

[a]Approximate acreages. Thinned to approximately 80 sq. ft. basal area.

Grazing

There is a history of heavy grazing on the study area by both sheep and cattle.

Records going back to 1938 show that there were 21,963 cattle AUM's* on the study area during that year (Fig. 5), as compared to 2,126 AUM's in 1980. As ranch ownership changed hands and the original five allotments were combined into three, there were periodic reductions in AUM's. Most of these were made by the Forest Service upon ownership changes. In 1977 and 1978 a deferred rest-rotation grazing system was implemented in each allotment. The entire area is utilized as summer range only (June-October). Both deferment and rest are programmed into the system to promote plant vigor, litter accumulation, and seedling establishment. A primary objective of the grazing system is not to exceed 35% livestock utilization of the desirable perennial forage species. Since implementation of the rest-rotation grazing system, there has been a 77% reduction in AUM's and a noticeable improvement in ground cover.

*Animal units per month.

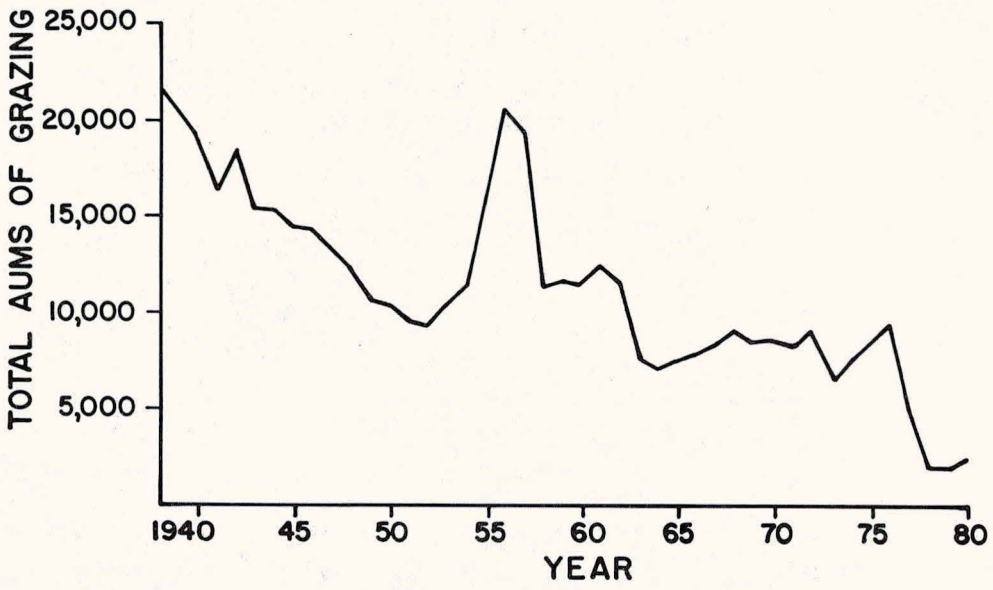

Fig. 5. Cattle AUM's on the study area, 1938-1980.

Consistent records are not available for long term sheep use. There are three sheep allotments, and it appears that there is approximately one-third the number of sheep present now as in the early 1900s. Scattered records show one allotment had 3,960 sheep in 1919 compared to 1,471 in 1941 and 1,406 in 1980.

Sheep use generally occurs during the period of May through October 15. The Forest Service has initiated a routed pattern of sheep grazing with a deferred-rotation system. This has basically been the pattern since 1941.

Recreation

Hunting, fishing, camping, hiking, sightseeing, fuelwood gathering, and bird watching are a few of the recreational uses on the area. Hunters are present from September 1 to the first week in December. Fishermen, hikers, and campers are present throughout the summer and fall. There is easy access to the entire area except during severe winters.

Roads

The road system in the study area has 73.2 miles of double lane (black topped and gravel), 146.3 miles of single lane (gravel), 255.1 miles of single lane (drained), and 183.2 miles of travelways (logging roads). Forest

Service personnel estimate that two-thirds of the travelways will eventually be closed in meeting long-term management objectives.

METHODS OF STUDY

Trapping

A portable box trap (Fig. 6) was used to capture wild turkeys for banding, marking, and release. The trap consisted of 33-inch-high sections 5 feet long which could be put together to make a 5-foot-wide trap from 10 to 20 feet long. The length of the trap depended upon the number of turkeys using the trap site. If less than 20 birds, two sections were used; from 20 to 35 birds, three sections were used; and four sections were used for more than 35 birds. If the trap was over 10 feet long, a door was used at both ends.

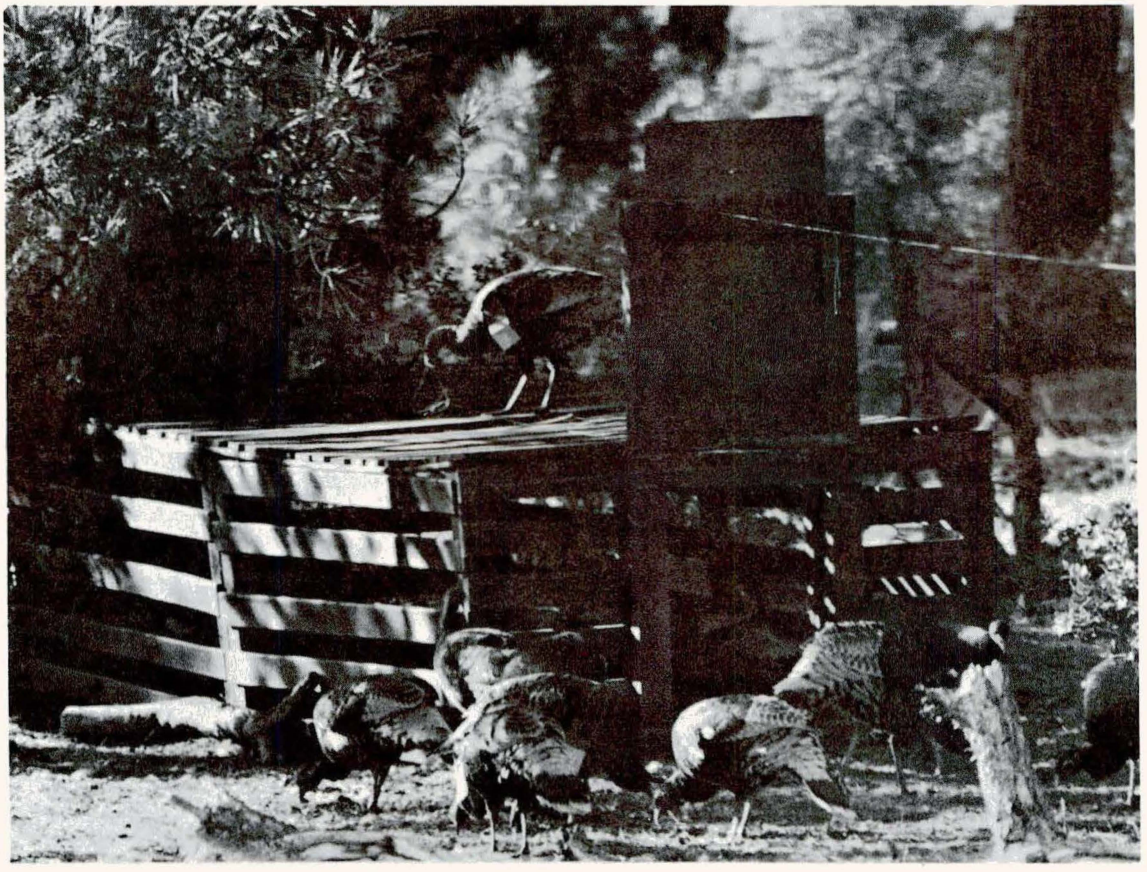

Fig. 6. Box trap used for capturing turkeys.

Trapping was conducted over a four-winter period (1971-1972 through 1974-1975), starting in December of each year and continuing until dispersal of flocks in the spring. Only those areas with high concentrations of wintering turkeys were selected for trapping.

Sexing and Aging

Birds in the Hand

Sexing. Birds were sexed by overall appearance and breast feather characteristics (Lewis 1967). Hens (both adult and juvenile) were distinguished by white tipped feathers. Juvenile hens had a narrower band of white on the feather than the adult. Adult gobblers were evident by their black tipped breast feathers and appearance. Juvenile gobblers had few black tipped feathers, but generally the feather tips had a very narrow gray-buff band followed by black.

Aging. Adults were differentiated from juveniles by examining the tips of the ninth and tenth primaries (Lewis 1967). The pointed, nonbarred tips of these feathers identified a juvenile (Fig. 7), while the tips of the feathers of the adult were barred and more rounded (Fig. 8).

Birds in the Field

Aging. The difference in the greater upper secondary covert patch was used to differentiate between juveniles and adults (Fig. 9). This technique was described by Williams (1961) for Florida turkeys (*Meleagris gallopavo osceola*) and it worked for the Merriam turkey. The distinctive features of the covert are:

1. "Juvenile coverts become increasingly shorter, browner, and less glossy distally (except the most distal two), those of the adult are uniformly dark and glossy and as a group present a more graceful and symmetrical outline in profile";

2. "The most distal coverts of the juvenile are much longer, darker, and more glossy than adjacent coverts"; and

3. "In the adult coverts are longer, giving the covert patch a greater antero-posterior depth. The young turkey retains its distinctive greater upper secondary coverts until they are replaced during the postnuptial molt of late summer in the individual's second year."

Hunter Kills

Birds killed by hunters are often completely picked and no feathers are available for sexing and aging. Tagging regulations, however, require that one leg be left on the bird, and it can be used to determine juveniles from adults and to sex adults as follows:

1. The leg of the adult is deep purplish-red in color with large distinct scales. The presence of a spur indicates gobblers.

2. The leg of the juvenile is brownish in color with smaller scales that have a less distinct outline (Lewis 1967).

Field Surveys

Production

Surveys were made annually during late July to mid-September, from 1960 through 1980, to determine the hen:poult and gobbler:hen ratios. These data, obtained through early morning and late evening road transects, provide information on productivity, and when related to climatic and vegetative conditions and to hunter harvest is useful in estimating approximate population levels. Winter surveys (December-January) were conducted during 1971-1975 at trap sites, and hen:poult ratios were again obtained. These data were used in determining poult survival.

Distribution

Twelve years (1968-1980) of turkey distribution records were maintained and related to habitat types and prominent land uses. All of the turkey observations made during fall surveys in 1973-1977 were related to habitat types, livestock use (cattle or sheep), if any, and vegetation condition (height and density of grasses and forbs). Seasonal turkey ranges were determined by plotting turkey observations on maps.

Harvest Data

Questionnaire

Statewide questionnaires were used for determining hunter success and the number of days hunted. Approximately 23% of the turkey tag purchasers were sampled (generating a 55% return) for the fall hunts. All spring permit holders were sent questionnaires; 68% of the questionnaires were returned.

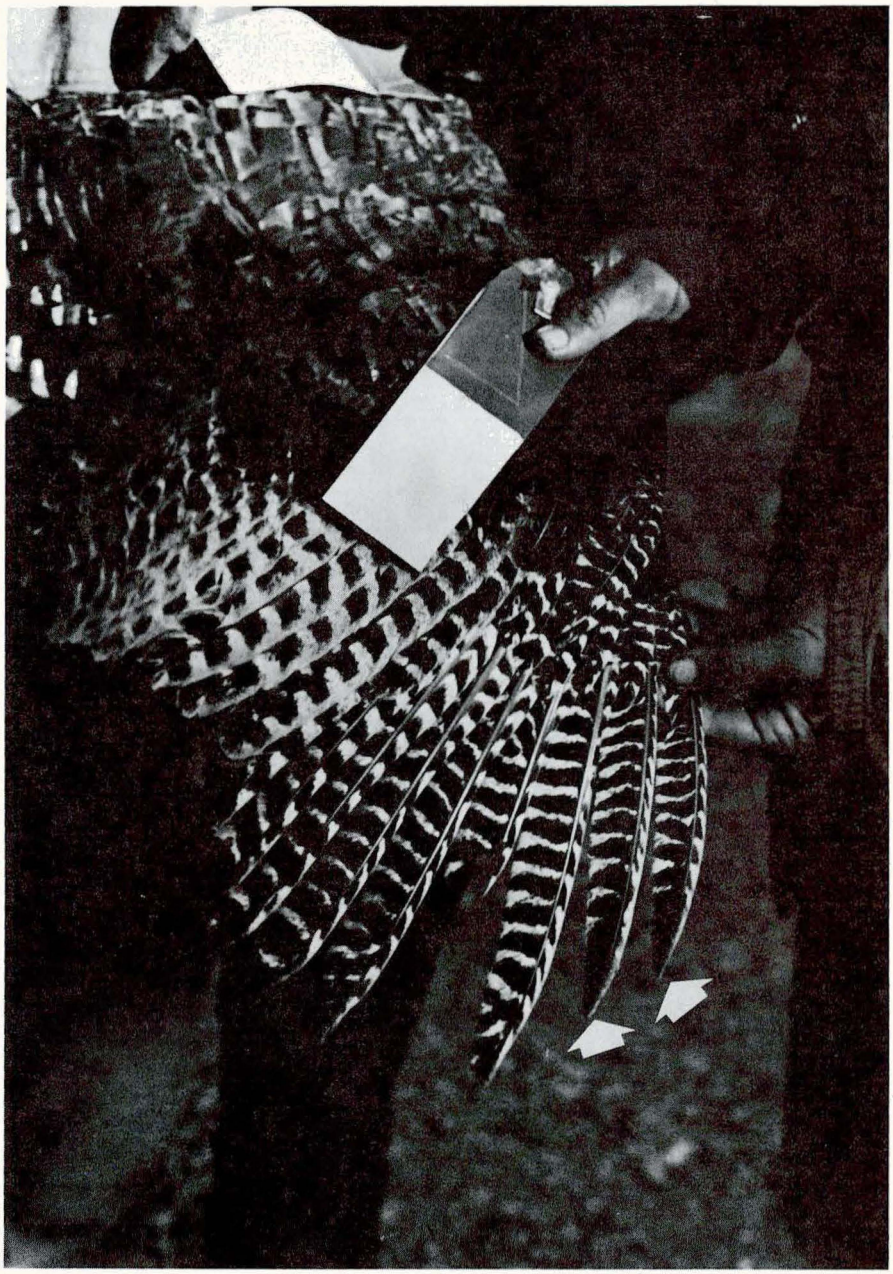

Fig. 7. The wing of a juvenile turkey showing the pointed, nonbarred tips of the ninth and tenth primaries.

Fig. 8. The wing of an adult turkey showing the more rounded, barred tips of the ninth and tenth primaries.

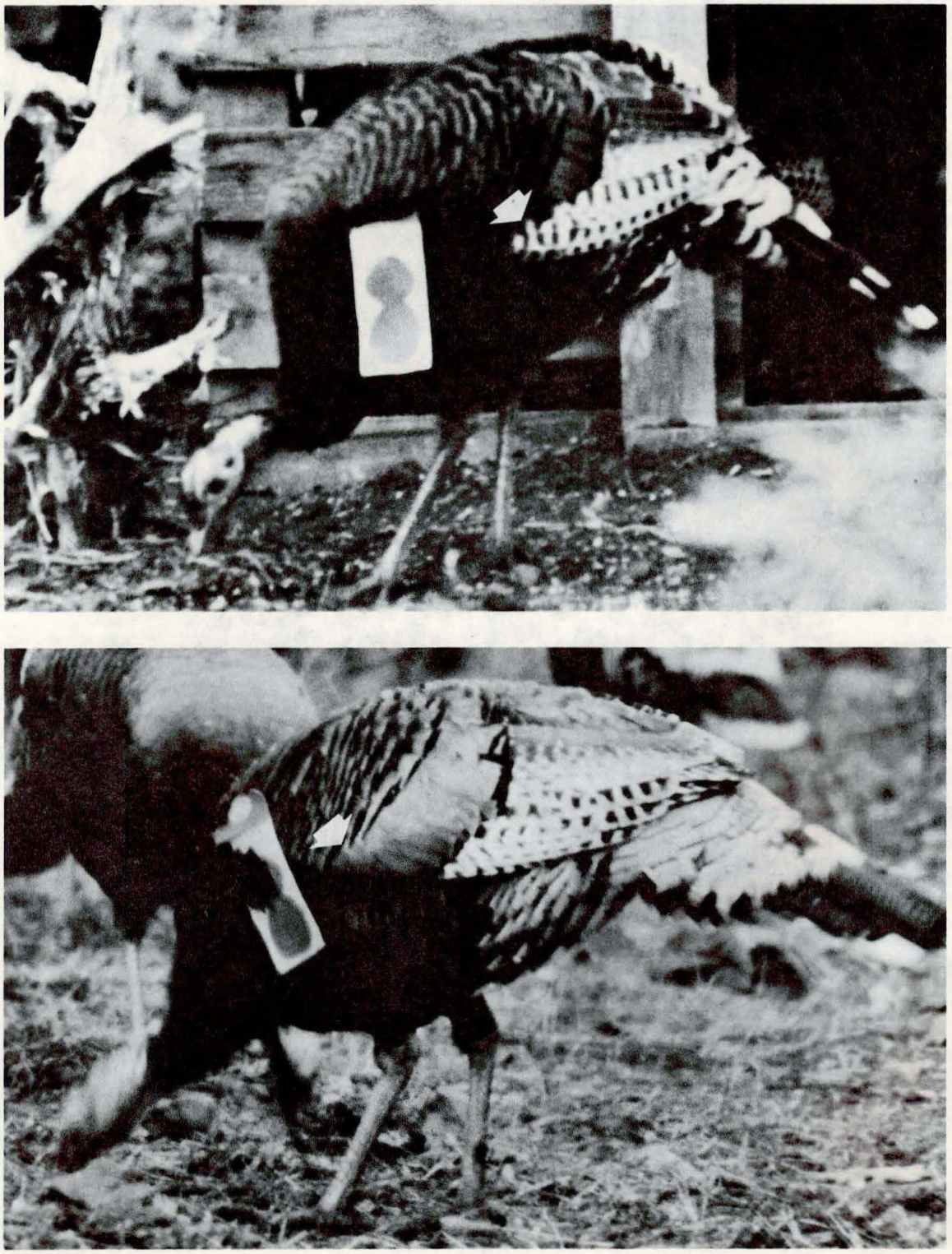

Fig. 9. Greater upper secondary coverts (arrows) showing the noticeable difference between juvenile (top) and adult (bottom) turkeys.

During 1974, 1975, and 1977, a special questionnaire requesting information on hunt methods (calling, stalking, or driving), hunter success, and location of kill was mailed to spring permit holders.

Field Checks

Field checks of hunters were made during both the spring and fall hunts. This information was useful in making a subjective evaluation of hunter effort, distribution, and success. Turkey sex and age data were also collected and recorded.

Habitat

A vegetation map (Fig. 2) was prepared so seasonal turkey distribution records could be depicted in relation to habitat types. Using the same scale as the vegetation map, it is possible to overlay major land uses (grazing, hunter concentration patterns, timbering, wood gathering, etc.) with preferred turkey habitats.

FINDINGS

Trapping

During the four winter trapping and marking seasons, 11 trap sites were used (Fig. 10). The Buzzard Hill trap site, located near one of the largest and most consistently used winter roost, was the most productive.

Four hundred and twelve turkeys were caught during the study period; 245 were marked with patagial wing markers (Tables 5 and 6). Ninety-two birds were re-trapped (54 caught the same year as marked, and 38 caught from one to seven years after marking). Thirty-three turkeys were captured for transplanting in 1976 and 1979.

Composition of marked birds was 24 adult gobblers, 39 juvenile gobblers, 135 adult hens, and 47 juvenile hens. Twenty-seven adult hens had beards from 2 to 7 inches in length. All 24 adult gobblers were bearded, one having a double beard measuring 8-3/4 inches and 4-1/2 inches. None of the juvenile gobblers had beards that extended beyond the feathers. One hen, marked as an adult with no obvious beard on December 1, 1971, had a 3-1/2-inch beard when killed on October 5, 1975. Another adult hen had a 5-inch beard when marked on December 21, 1971. This hen was retrapped on January 8, 1975, and her beard had grown to 7 inches.

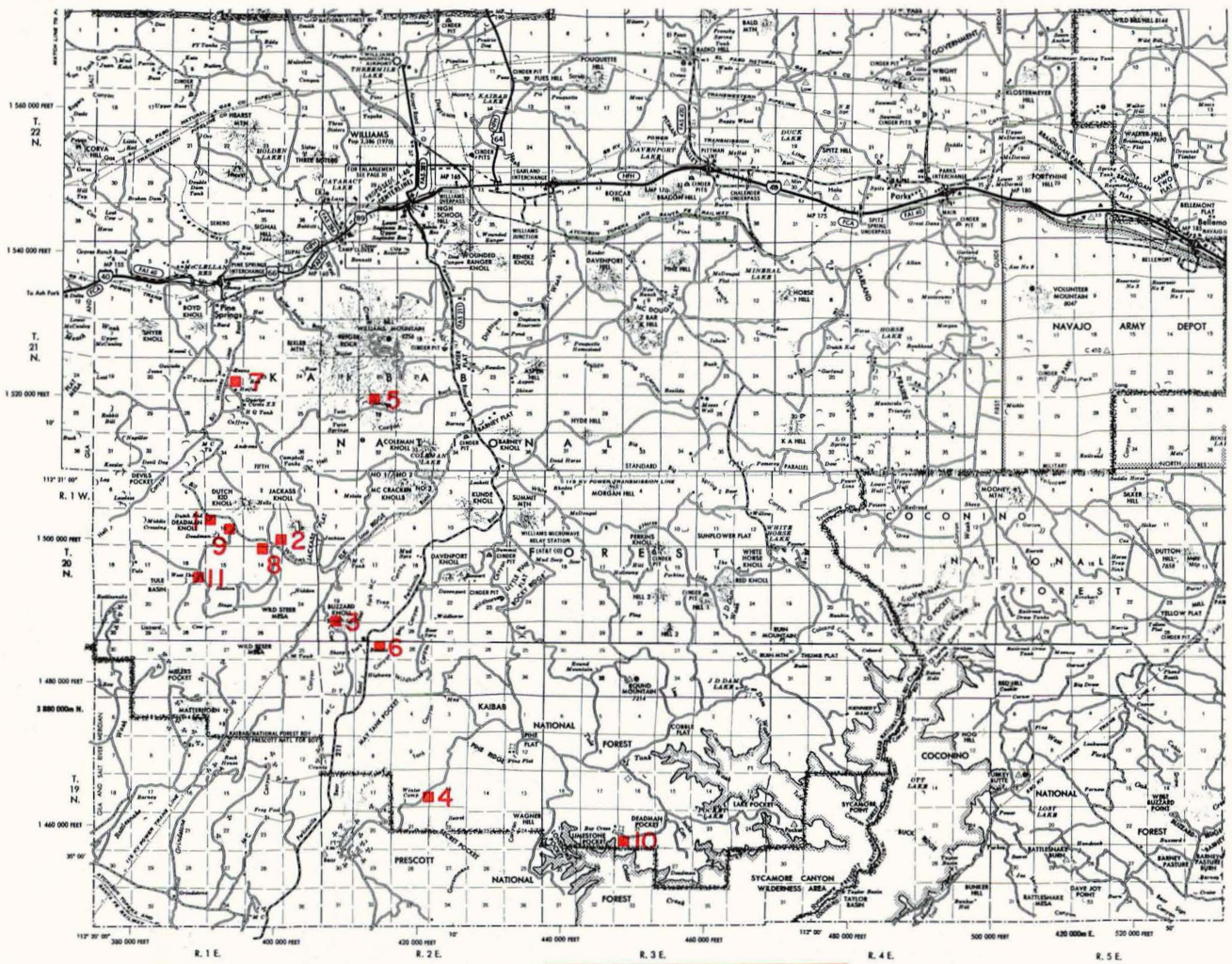

Fig. 10. Location of trap sites.

Table 5

Sex and Age Composition of Turkeys Captured and Marked by Trap Site

Trap Site	Period(s) of Use	Birds Marked				
		Adult Male	Juvenile Male	Adult Female	Juvenile Female	Total
Dutch Kid	11/29/71-01/09/72	--	--	29	--	29
Jackass Flat	12/02/71-12/11/71	4	--	3	--	7
Buzzard Hill	01/12/72-01/24/72	--	2	17	--	19
Buzzard Hill	12/14/72-01/11/73	--	2	8	7	17
Buzzard Hill	01/14/74-03/05/74	--	5	10	14	29
Winter Camp	01/28/72-02/15/72	--	1	22	2	25
Twin Springs	02/01/72-02/02/72	5	--	--	--	5
Bandit Tank	12/27/72-02/14/73	--	1	7	3	11
Bandit Tank	03/08/75-03/19/75	--	--	10	2	12
XX Ranch	01/17/73-01/23/73	12	--	--	--	12
XX Ranch	01/12/74-01/19/74	2	6	8	1	17
Cow Tank	12/24/73-01/04/74	1	5	4	1	11
Deadman	03/12/74	--	--	4	1	5
Bar Cross	02/23/74	--	1	1	1	3
Ice Tank	12/21/74-01/16/75	--	16	12	15	43
Total marked		24	39	135	47	245

Table 6

Summary of Turkey Captures in Study Area

Number of birds marked, 1971-1975	245
Retraps	
From same year	54
From previous years	38
Unsuccessful tagging procedure	38
Trapped for transplant	
1976	20
1979	13
Escapes	3
Known trap mortality	1
Total	412

The plastic-impregnated nylon material used for tags showed considerable wear after several years; however, retention was good. Visibility of tags varied according to conditions of observation. When turkeys were relaxed and undisturbed tags were easily seen; however, when the birds were running or moving rapidly tags were difficult to see. The two-color combination was easily seen with the aid of binoculars, but the public often reported only one color. The presence of tags did not appear to make marked birds more vulnerable to hunters. Hunters who were questioned usually were not aware that their birds were marked until they approached their kill.

Movements of Marked Birds

During the winter months, marked bird observations showed that all birds remained on the winter range within the study area. During spring and summer, 42.6% of the observations reported by the general public were in Wildlife Management Units 6B, 7, and 10 (Fig. 11). The longest movement was that of a hen that traveled 39 miles to its summer range.

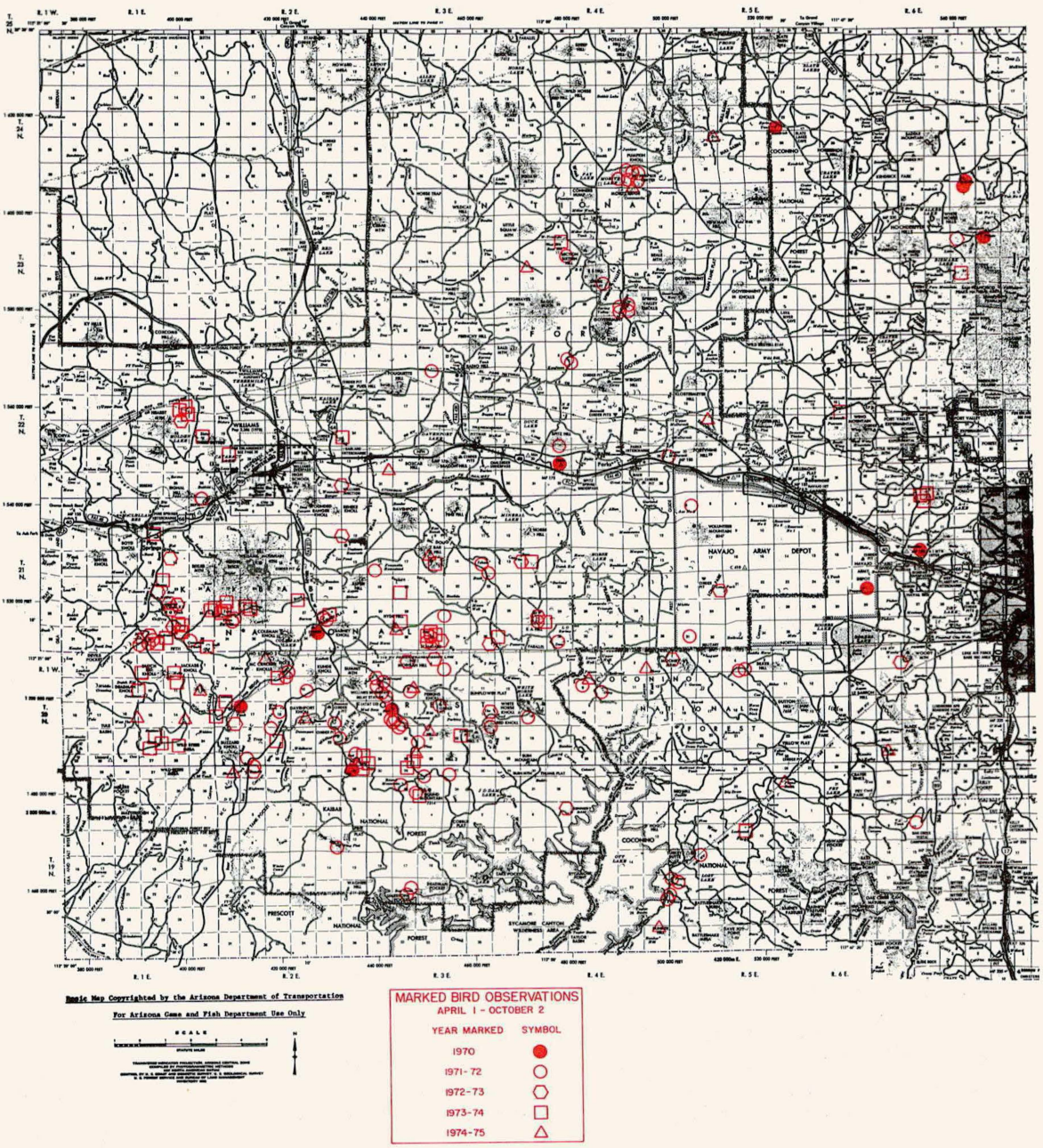

Fig. 11. Movements of marked turkeys.

The annual movement pattern, based on marked-bird observations, takes place from the winter range (5,800-6,800 ft.) during the spring dispersal. At this time there is a general movement to higher elevations (6,000-9,000 ft.) where birds nest, rear their broods, and summer. In the fall, the birds begin their return to the winter range.

Habitat Utilization

There were 160,140 acres used as turkey summer range, 70,460 acres as winter range, and 54,200* acres used all year (Fig. 12 and Table 7).

Water

Use of water by turkeys was greatest during the dry, fall months of September, October, and early November. Breeding groups of turkeys were frequently observed around stock tanks in April and early May, but were often seen feeding in green vegetation, rather than actually drinking. There was also some indication that the small openings around water were used as display grounds by gobblers.

Cover

Feeding. In spring, summer, and fall, small openings, edges of large openings, and drainage bottoms within ponderosa pine and pine-oak associations were consistently used by turkeys of all sexes and ages (hens, poults, and bachelor flocks of gobblers). Also, the turkeys used fairly open stands of trees with various combinations of saplings, poles, and intermediates within these associations. During early morning and late afternoon, 85% of all turkey observations were in these areas. Midday observations were almost always in dense stands of timber. Undisturbed turkeys would feed rapidly across small openings or along the edges of larger ones, but would immediately retreat to cover when frightened. Turkeys seldom ventured more than 100 yards from cover.

In winter, use was predominantly in the heavier cover offered by pine-oak, pine-oak/pine-juniper, or pine-juniper. This probably occurred because there was available mast and less snow under the denser canopies.

Shaw (1977) found that hens and poults preferred a mixture of sapling, pole, and mature ponderosa pines, with

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*These figures include an overlap of summer and winter range and exceed the 176,400 acres of total habitat.

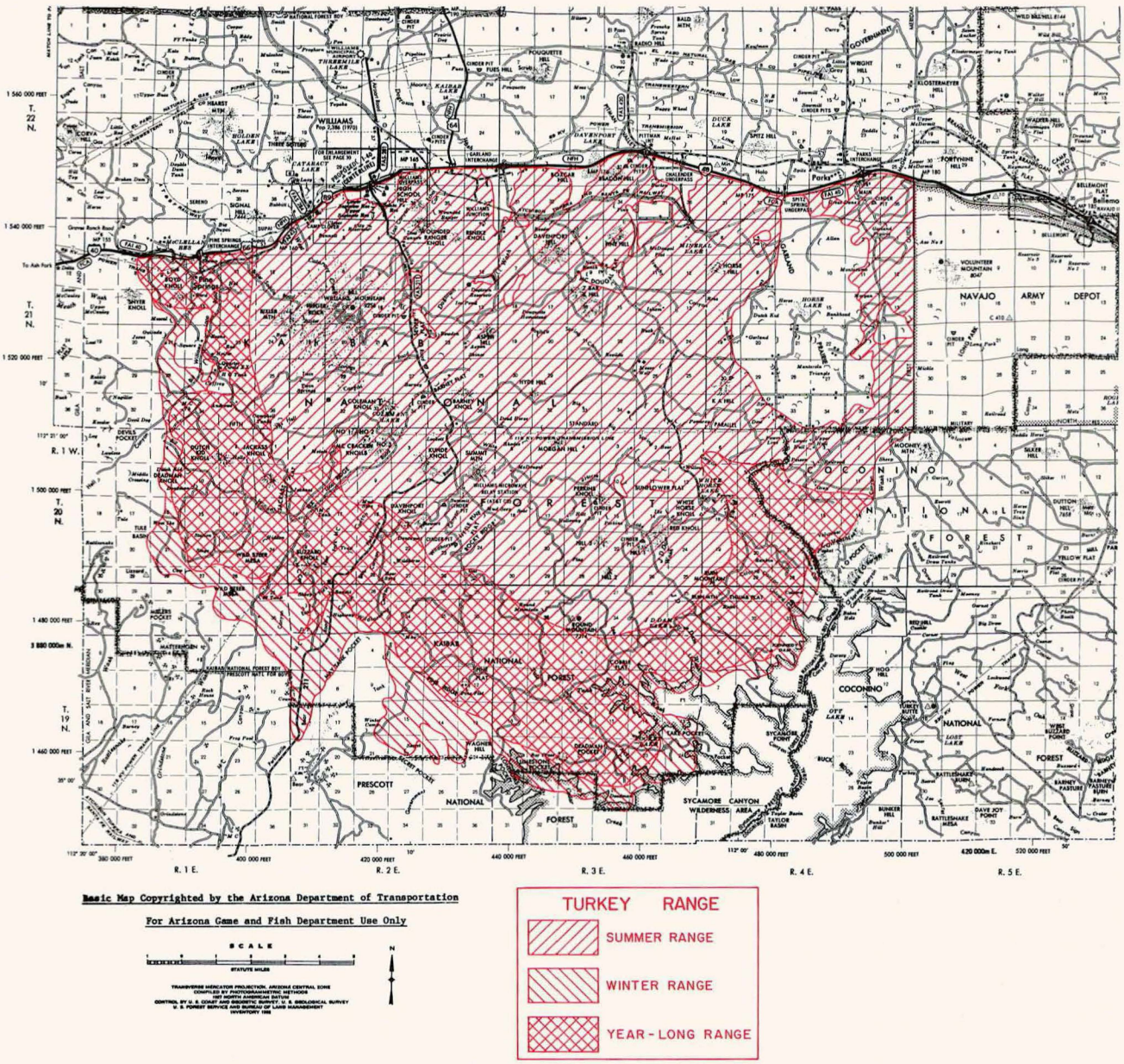

Fig. 12. Winter, summer, and year-around turkey range.

Table 7

Vegetation of Summer and Winter Turkey Ranges

Classification[a]	Association	Summer		Winter	
		Acres	% of Total	Acres	% of Total
322.112	Douglas fir-white fir	1,400	0.8	0	--
322.113	White fir-Douglas fir-ponderosa pine	600	0.4	800	1.0
322.127	Aspen	280	0.2	0	--
322.123	Ponderosa pine	58,800	36.5	7,080	10.1
322.125	Ponderosa pine-Gambel oak	84,360	52.7	46,860	66.5
332.111	Pinyon-juniper	2,360	1.5	9,200	13.1
332.115	Juniper-pinyon chaparral ecotone	800	0.5	3,040	4.3
342.314	Turbinella oak	940	0.6	1,900	2.7
352.241	Mixed grass-(Ponderosa pine)	10,620	6.6	900	1.3
352.243	Mixed grass-(pinyon-juniper)	280	0.2	680	1.0
	Totals	160,140		70,460	

[a]Brown and Lowe (1974).

abundant grasses and forbs during the summer. At this same time, gobblers preferred higher elevations and the pine-oak association. Scott (1975) reported 66% of his summer and 16% of his winter turkey observations were on meadows, with the birds no farther than 50 yards from cover.

Nesting. Primary turkey breeding range on the study area encompasses 84,672 acres (Fig. 13). There is some breeding habitat outside of this range which is classified as secondary. Six nests were found during the study period by USFS personnel, usually by flushing the hen from the nest. Of these, five were associated with logging slash and one was in a clump of oak sprouts. In all of the pine slash sites the needles were still attached to the slash. Three of these sites were known to have been abandoned by the hen after the disturbance.

Burget (1957) and Hoffman (1962) indicated that nesting hens in Colorado preferred inaccessible slopes with dense thickets of oak or areas of cut-over ponderosa pine with slash remaining. Petersen and Richardson (1975) found nest sites in South Dakota on eastern slopes with grassy meadows, pine slash, and tree bases. Jones (1981), in New Mexico, found all nests located at tree bases, stumps, or under shrub-type vegetation on moderately steep slopes. Cover was provided by logging slash, shrubs, logs, or contour effects. He also found that mesic slopes were preferred and that the canopy cover was greater than on surrounding habitat.

Escape, Loafing, and Protective. In almost all instances, turkeys escaped to the nearest and thickest cover when disturbed. During one observation, 35 hens and poults were feeding in an open, narrow draw about 50 yards wide, when a bald eagle (Haliaeetus leucocephalus) passed overhead. The result was instantaneous flight by all birds to the nearest cover, a thick stand of junipers. As soon as the birds were under this they reassembled and continued feeding. Around trap sites, it was common for birds to feed on the bait then move off to denser cover and mill around (with some birds actually lying down) for up to an hour before finally moving off.

In summer, during occasional heavy thundershowers, birds were observed in very thick pole and sapling pine stands or dense pine-oak associations. In winter, during midday snowstorms, they were generally observed in pine-oak thickets or dense junipers and occasionally thickets of small pines. These observations indicate that thick cover is an important part of the turkey's habitat needs with regard to escape, loafing, and protection from extremes of weather.

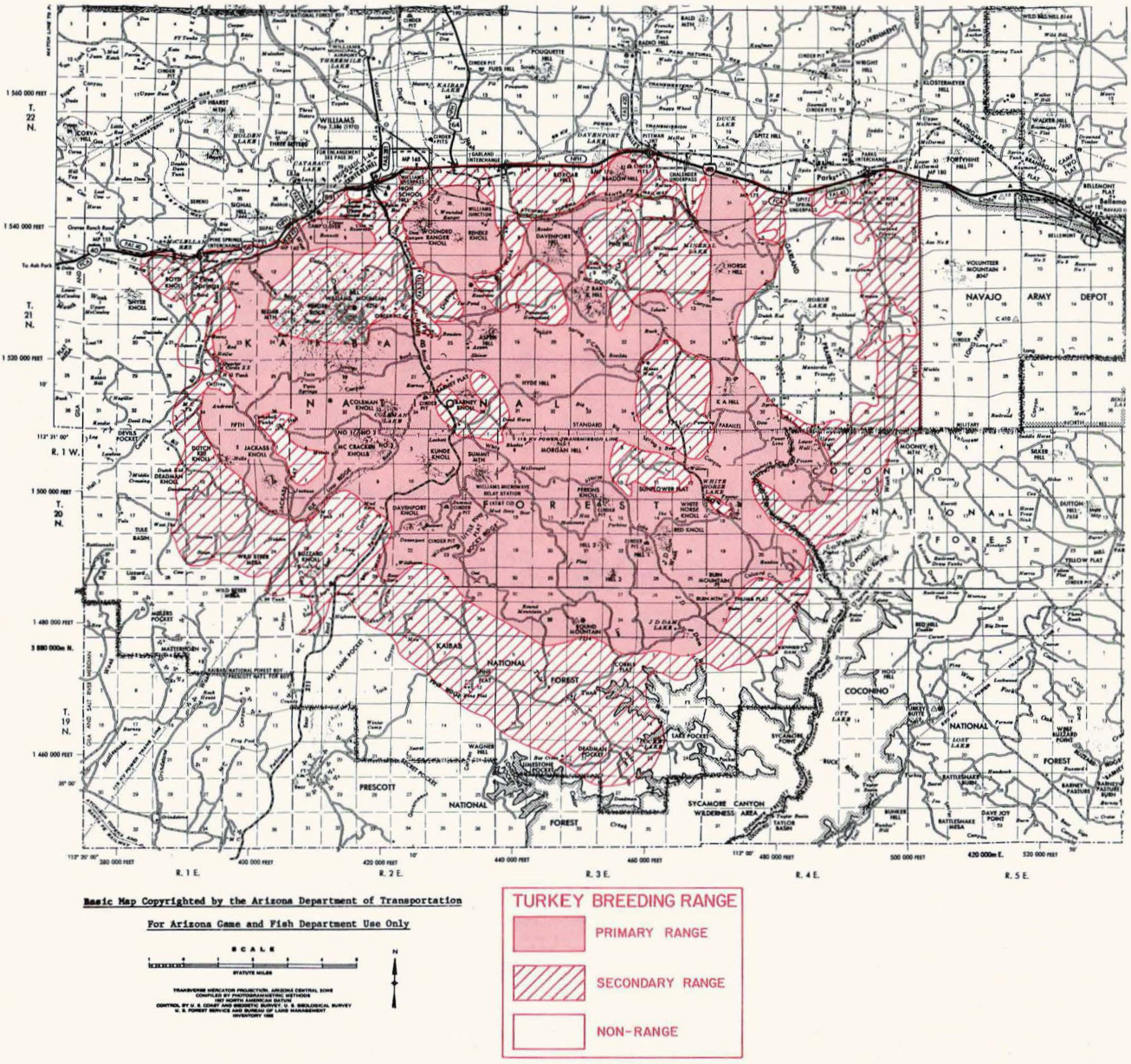

Fig. 13. Primary turkey breeding range.

Roosts. In 1975 a program of identifying and permanently marking roost sites* within the study area was initiated. Currently 178 roost sites have been marked (Fig. 14) with the objective of preserving these sites.

The first undertaking of this type was done on the 36 Tank timber sale area located in the heart of a high density turkey winter range. Forty-three roost sites were identified and marked on the 18.3 sections comprising the sale. The following data were obtained:

	Average No.
Trees per roost site	27.00
Acreage	0.94
Basal area (sq. ft. per acre)	94.00
Volume in board feet	10,349.00

Roost Site Aspect

Slope Exposure	No. Roost Sites	Slope Exposure	No. Roost Sites
North	8	South	6
Northeast	6	Southwest	4
East	9	West	7
Southeast	2	Northwest	1

Boeker and Scott (1969) and Jones (1981) found strong preference for eastern and northeastern roost site aspects. No significant difference in aspect was found on the study area. Many of the roost sites were located along roads. This was a result of previous cutting practices which caused the removal of interior roost trees but, for aesthetic purposes, left roadside trees. It also appears that, as a result of past timbering practices which were geared to the removal of mature and over-mature trees, the turkeys no longer have a wide selection of sites from which to choose a roost. There is still intense pressure to harvest trees on the remaining unmarked roost sites.

Production and Survival

Brood Surveys

The average hen:poult ratio on the study area over a 21-year period was 100:355 (Table 8). There were only three

*A roost site is a clump of mature or over-mature ponderosa pine, any or all of which may be used by turkeys for roosting.

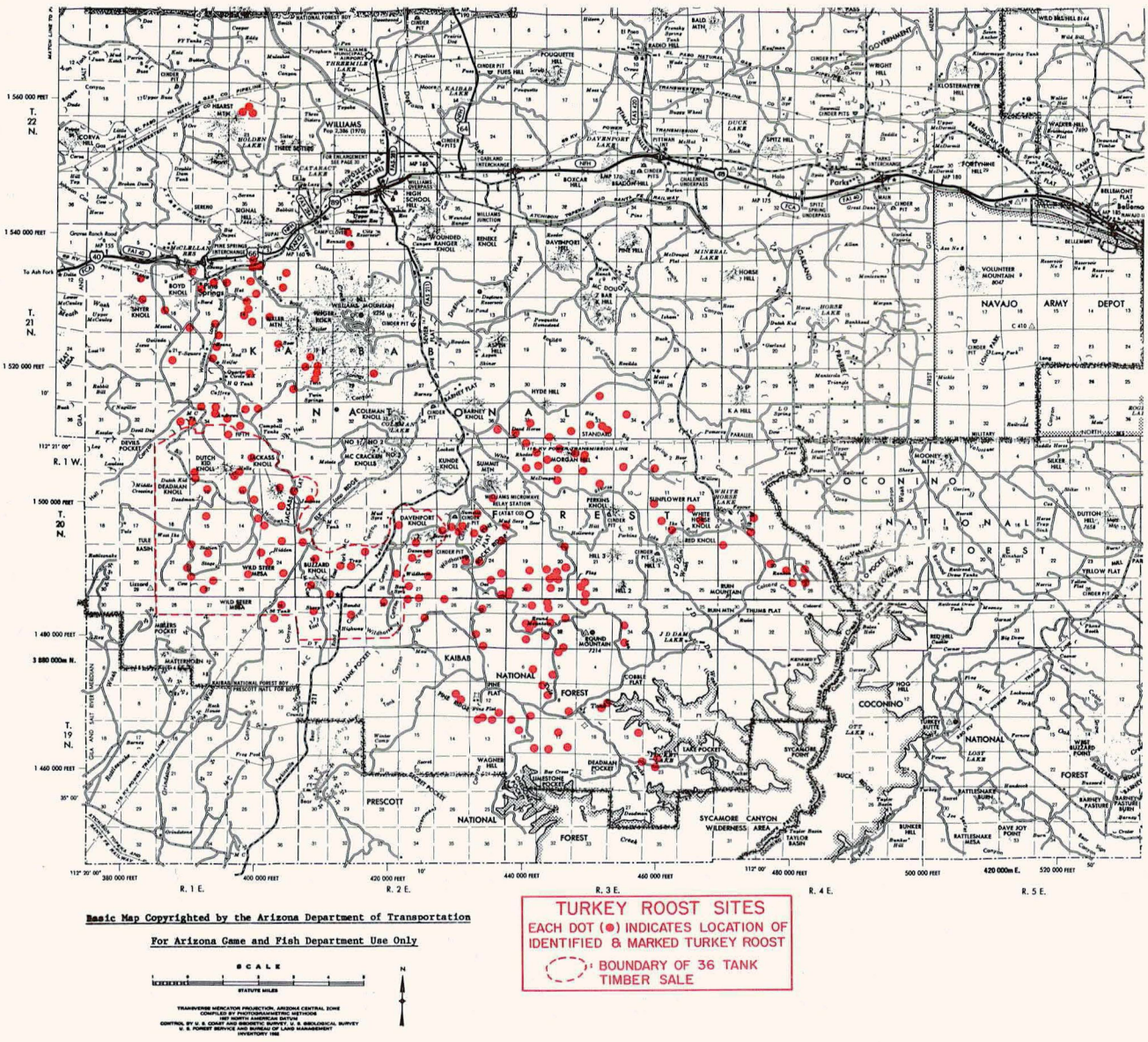

Fig. 14. Roost sites identified and marked in study area.

Table 8

Turkey Brood Surveys in Management Unit 8
1960-1980

Year	Gobbler		Hen		Poult		Total Class.	Gobblers per 100 Hens	Poults per 100 Hens
	No.	%	No.	%	No.	%			
1960	63	58.3	11	10.2	34	31.5	108	572	310
1961	43	46.2	12	12.9	38	90.0	93	358	320
1962	25	39.1	8	12.5	37	98.4	64	313	390
1963	62	53.9	16	13.9	37	32.2	115	388	230
1964	44	48.5	10	11.0	37	40.7	91	440	370
1965	24	32.9	12	16.4	37	50.7	73	200	310
1966	35	53.8	6	9.2	24	37.0	65	583	400
1967[a]	59	66.3	9	10.1	21	23.6	89	655	230
1968[b]	20	13.7	25	17.1	101	69.2	146	80	400
1969	15	9.9	24	15.9	112	74.2	151	63	470
1970	22	34.4	10	15.6	32	50.0	64	220	320
1971	20	40.8	10	20.4	19	38.3	49	200	190
1972	52	26.4	31	15.7	114	57.9	197	168	380
1973	26	14.1	27	14.7	131	71.2	184	96	480
1974	37	22.3	26	15.7	103	62.0	166	142	400
1975	19	11.0	37	21.4	117	67.6	173	51	320
1976	18	35.3	7	13.7	26	51.0	51	257	370
1977	13	26.5	8	16.3	28	57.2	49	162	350
1978	21	11.1	34	18.0	134	70.9	189	62	390
1979	19	29.2	8	12.3	38	58.5	65	238	475
1980	10	9.1	22	20.0	78	70.9	110	45	354
Average								252	355

[a]Winter snowstorm with five to seven feet of snow in December.

[b]First spring hunt.

years out of the 21 when the poult ratio dropped below 300 (1963, 1967, and 1971) and one year (1971) when it was below 200. Poult production has remained remarkably stable from year to year.

Poults are subjected to losses from the time of hatching, and many factors contribute to their demise. Inclement weather, particularly cold rains or wet snows, can cause major poult losses if they occur at the time of the hatch or when the chicks are very young. Predation, accidents, and hunters also reduce the population.

In the Bill Williams study area the survival of poults is poor. Brood surveys during August and September of 1971 through 1975 (Table 9) resulted in an average of 100 hens to 354 poults (essentially the same as the 21-year average for Unit 8). However, hen:young data collected again during December and January of the same years showed a substantial loss of poults, and the average hen:poult ratio was 100:64. There is no explanation for this loss.

Another investigation concerning poult survival was made in 1974 and 1975, when an attempt was made to compare hen:poult ratios on livestock ranges that were grazed at different intensities. The number of poults per hen utilizing heavily grazed pastures (50-60% utilization) was lower than those found on the rested pastures (Table 10). The data base is limited so firm conclusions cannot be drawn. However, the need for additional research is apparent.

Table 9

Late Summer to Winter Poult Survival, 1971-1975

Year	Poults:100 Hens	
	August-September Surveys	December-January Surveys
1971	190	7
1972	380	65
1973	480	84
1974	400	110
1975	320	56
Average	354	64

Table 10

Poult Survival on Various Livestock Pastures, 1974-1975

Type of Pasture	Birds Classified		Poults: 100 Hens	Mean Density of Ground Vegetation[a]	Mean Height of Ground Vegetation
	Hens	Poults			
		1974			
Cattle-grazed	11	16	145	Sparse	3"
Sheep, all.....	2	9	450	Sparse	8"
Cattle, rested ...	11	66	600	Medium	10"
		1975			
Cattle-grazed	20	31	155	Sparse	4.5"
Sheep, all	8	35	438	Medium	11.5"
Cattle, rested ...	9	51	567	Dense	12"

[a]Visual criteria used as shown below:
Sparse--mostly bare ground; entire turkey visible.
Medium--turkey partially visible.
Dense--turkey difficult to observe.

During the annual brood surveys gobblers were also classified (Table 8). It may be significant that the gobbler:hen ratio declined substantially following a severe winter storm in 1967 and the initiation of spring hunts in 1968.

Longevity

The oldest known age of hens and gobblers, from hunter kills and sight observations of marked birds, was one hen a minimum age of 8-1/2 years, and two hens a minimum age of 7 years, 3 months. One gobbler was a minimum age of 8 years, 3 months, and one was a known age of 7 years, 3 months. Survival of adult hens in the 2-1/2, 3-1/2, and 4-1/2 year age classes is good (Table 11).

Table 11

Estimated Survival of 46 Adult Hens Marked December-January of 1971-1972 (Minimum age 1-1/2 years when marked)

Years After Marking	Minimum Age	Max. Available for Observation[a]	Non-duplicate Birds Observed	% Observed (minimum survival)
0 (1971-72)	1-1/2	46	46	100.0
1 (1972-73)	2-1/2	44	18	40.9
2 (1973-74)	3-1/2	42	13	30.9
3 (1974-75)	4-1/2	42	11	26.2
4 (1975-76)	5-1/2	41	4	9.7
5 (1976-77)	6-1/2	41	3	7.3
6 (1977-78)	7-1/2	40	2	5.0
7 (1978-79)	8-1/2	40	1	2.5

[a]Known mortalities subtracted from 46.

Hunting

History

For a brief, concise history of Commission actions on turkey management, see Shaw (1977, pp. 20-21). The Bill Williams Mountain area was first opened to hunting on a limited permit basis in the fall of 1953 (Jantzen 1954). At that time it was combined with what are now Wildlife Management Units 6B and 7. Fall hunting was conducted on a permit basis until 1963, at which time Unit 8 was delineated and opened to unlimited fall turkey hunting with the rest of the state. This was the first year hunt data became available on a unit basis. Wildlife Management Unit 8 has continued to have unlimited fall hunting to present. The unit has accommodated 7% of the state's fall turkey hunters and provided 7.2% of the state harvest on 3.3% of the state's turkey habitat (excluding Indian land).

In 1965 the first spring turkey hunt took place in Wildlife Management Unit 1A of the White Mountains (Anon. 1966). The hunt was readily accepted, and each year thereafter more and more units were opened to spring hunts until it became a statewide practice.

The first spring turkey hunt in the study area was in 1968 with 100 permits. Permits were increased to 250 in 1969, and since 1975, 400 permits have been issued annually. Since 1969, the area has been used by 9.9% of the state's spring turkey hunters and has provided 9.3% of the state harvest on 3.3% of the habitat, excluding Indian lands.

Fall Hunting

The fall turkey season, open for any turkey, has traditionally been a 9-day hunt held in early October. In 1980, the fall season was extended to 17 days which included three weekends.

Turkeys are hunted in the fall in four basic ways:

1. Road hunting (continually driving along roads until turkeys are seen).
2. Sitting in a blind or vehicle at water.
3. Walking (still hunting).
4. Calling.

Road hunting is by far the most popular method and accounts for the majority of the kill. Water-hole hunting is the second most popular method and accounts for a small part of the kill, except in very dry years, when this type of hunter is more successful. Still hunting and calling account for only a small part of the harvest. Hunters that use calls are few in number but have the highest success rate.

For the past 18 years, this area has averaged 880 hunters (high of 1,084 in 1971, low of 651 in 1979), with a kill of 106 turkeys (high of 179 in 1973, low of 24 in 1976), and a success rate of 12.1% (high of 20.7% in 1975 and 1978, low of 3.6% in 1976). Hunter density averaged 3.2 hunters per square mile (high of 3.9 in 1971, low of 2.4 in 1976-1977) and they spent 2.5 days in the field (Table 12).

Eleven years of questionnaire data show that the statewide crippling loss was 9.8% of the kill. The reported loss is minimal because of the reluctance of hunters to admit wounding. Some hunters, particularly those using shotguns, often think they missed, when in reality they hit turkeys. Shaw (1977) conducted checking stations on the Moqui (Management Unit 9) for three years and found a crippling loss equal to 13.6% of the kill. He also reported that an additional 34.1% of the hunters had shot at and missed turkeys.

Table 12

Fall Turkey Harvest in Management Unit 8, 1963-1980. Questionnaire Data.

Year	No. of Hunters	Hunter Days	Total Harvest	% Success	Avg. Hunter Days	Hunter Days per Kill	Hunter Density per Square Mile
1963	855	1,970	57	6.7	2.3	34.6	3.1
1964	745	1,775	59	7.9	2.4	30.1	2.7
1965	700	1,599	140	20.0	2.3	11.4	2.5
1966	927	1,961	115	12.4	2.1	17.1	3.4
1967	966	2,256	95	9.8	2.3	23.7	3.5
1968	966	2,183	106	10.9	2.3	20.6	3.5
1969	864	1,986	125	14.4	2.3	15.9	3.1
1970	1,036	2,407	147	14.2	2.3	16.4	3.8
1971	1,084	2,597	108	9.9	2.4	24.0	3.9
1972	971	2,545	79	8.1	2.6	32.2	3.5
1973	907	2,911	179	19.7	3.2	16.3	3.3
1974	903	2,262	77	8.5	2.5	29.4	3.3
1975	765	2,137	158	20.7	2.8	13.5	2.8
1976	673	1,972	24	3.6	2.9	82.2	2.4
1977	1,038	2,095	91	8.8	2.0	23.0	3.8
1978	844	2,208	175	20.7	2.6	12.6	3.1
1979	651	1,971	67	10.3	2.7	26.4	2.4
1980	951	2,821	124	13.0	3.0	23.7	3.5
Avg.	880	2,208	106	12	2.5	25.2	3.2

The average composition of the kill for these 11 years (Table 13) was 19% adult toms (range 10-33%), 30% adult females (range 17-40%), and 51% poults (range 33-63%).

It was possible to obtain some insight on mortality from hunter kills of birds of known sex and age. Forty-five hunter kills were recorded from 245 marked turkeys, representing an overall recovery rate of 18.4%. The composition of the harvested birds was 36.5% gobblers and 12.1% hens. Twenty-five percent of the adult males (minimum age 1-1/2 years) trapped and marked were known to have been harvested, while 43.6% of the juvenile males were killed. The return of birds captured as adult hens (minimum age 1-1/2 years) was 9.6% and juvenile hens was 19.1%.

Table 13

Composition of Fall Turkey Kill as Determined From Field Checks

Year	Total Harvest[a]	Total Classified Field Checks	% Sample	Adult Male		Adult Female		Poult	
				No. of Birds	% of Total	No. of Birds	% of Total	No. of Birds	% of Total
1966	115	20	17.4	3	15.0	6	30.0	11	55.0
1969	125	35	28.0	7	20.0	6	17.1	22	62.9
1970	147	17	11.6	2	12.0	5	29.0	10	59.0
1971	108	15	13.9	5	33.3	5	33.3	5	33.4
1972	79	15	19.0	2	13.3	6	40.0	7	46.7
1973	179	24	13.4	5	20.8	7	28.2	12	50.0
1974	77	31	40.3	8	25.8	9	29.0	14	45.2
1975	158	16	10.1	2	12.5	6	37.5	8	50.0
1976	24	6	25.0	2	33.3	2	33.3	2	33.4
1977	91	7	7.7	1	14.3	2	28.6	4	52.1
1979	67	10	14.9	1	10.0	4	40.0	5	50.0
Total	1,177	196		38		58		100	
Average			16.6		19.0		30.0		51.0

[a]Estimate from questionnaire returns.

Spring Hunting

The spring hunt is open for bearded turkeys and consists of two separate 9-day seasons (one opening in the middle of April and the other opening to include the first week in May).

The preferred methods of spring hunting were determined from a supplementary questionnaire distributed to hunters in 1974, 1975, and 1977 (Table 14). Calling is obviously the most effective method of hunting, and at present (1981) almost every spring turkey hunter uses a call.

In analyzing the spring hunt data (Table 15) it was evident that the split season resulted in a higher harvest as well as enabling more hunters to participate with lower hunter densities. The number of days spent in the field was essentially the same for all hunts, indicating that the spring hunter is basically a one-weekend hunter.

The composition of the spring kill, based on 108 birds checked in the field over a 13-year period, was 85.2% adult gobblers, 13.9% juvenile gobblers, and 0.9% bearded hens. The low percentage of juvenile gobblers in the bag may be influenced by the author's observation that only 29% of these birds have beards that are easily seen at this time of year.

Table 14

Methods and Success of Spring Turkey Hunters

Year	Hunting Method % of Hunters			% Harvest by Hunting Method		
	Calling	Still-Hunting	Driving	Calling	Still-Hunting	Driving
1974	42.9	40.4	16.7	75.0	16.7	8.3
1975	46.6	39.0	14.4	82.4	17.6	0
1977	56.0	29.0	15.0	91.3	8.7	0
3-year total	48.5	36.3	15.2	84.6	13.5	1.9

Table 15

Spring Turkey Harvest in Management Unit 8, 1968-1980

Year	Permits	Hunters	Hunter Days	Kill	% Success	Avg. Days per Hunter	Avg. Days per Kill	Hunters per Square Mile Primary Breeding[a]
1968	100	81	176	6	7.4	2.2	29.3	0.6
1969	250	209	504	12	5.7	2.4	42.0	1.6
1970	250	203	496	26	12.1	2.4	19.1	1.5
1971	250	195	484	17	8.7	2.5	23.5	1.5
1972	250	193	506	12	6.2	2.6	42.2	1.5
1973	250	129	318	12	9.3	2.5	26.5	1.0
1974	250	182	431	18	9.9	2.4	23.9	1.4
1975(1)[b]	200	148	414	14	9.5	2.8	29.6	1.1
1975(2)	200	130	325	9	6.9	2.5	36.1	1.0
1976(1)	200	95	234	9	9.5	2.5	26.0	0.7
1976(2)	200	138	356	14	10.1	2.6	25.4	1.0
1977(1)	200	130	347	21	16.2	2.7	16.5	1.0
1977(2)	200	129	359	15	11.6	2.8	23.9	1.0
1978(1)	200	110	328	16	14.5	3.0	20.5	0.8
1978(2)	200	142	342	9	6.3	2.5	39.1	1.1
1979(1)	200	99	237	6	6.1	2.4	39.5	0.7
1979(2)	200	123	375	10	9.1	3.0	37.5	0.9
1980(1)	200	102	302	12	12.0	3.0	25.2	0.8
1980(2)	200	122	351	15	12.0	2.9	23.4	0.9

[a]Primary breeding range encompasses only that portion of breeding range where birds were consistently observed.

[b](1)-(2) indicate split seasons.

The crippling loss during the spring hunt, derived from nine years of statewide questionnaire data, was equal to 22.4% of the kill. This was a much higher rate than during the fall hunt. This increase in crippling can be attributed to the size of the gobblers as compared to hens and poults. Gobblers are harder to kill and hunters need better judgment in shot selection.

Population Trends

As with most game birds, the turkey has the reproductive capability to quickly reach its environmental capacity. Twenty-one years of production data (Table 8) show a generally stable turkey population in the study area. The number of hunters participating in the fall hunts has been remarkably stable and so has the number of days hunted. However, fall harvest data (Table 12) show a considerable fluctuation in kill that does not necessarily correlate with annual production or hunter effort.

The composition of the harvest during the fall hunt (approximately 50% adults and 50% young) indicates hunter selectivity toward the larger adult birds. The total harvest, including crippling loss, is perhaps on the low side when considering population capability. The number of birds harvested in the spring appear to be in balance with the population level.

Hard data concerning population trends are lacking but habitat management is the key to maintaining turkey populations in the future. Some early warning signs are present and should be heeded.

RECOMMENDATIONS

Habitat

The habitat management goal for Merriam turkey should be to provide continuity of preferred habitat (food, water, cover, and roosting requirements) that enables the birds to reproduce and survive. It is pointless to establish an area of winter range for management, for example, and then ignore the breeding, brooding, summer, and fall ranges. There are few specific habitat recommendations for Merriam turkey in the literature. The following recommendations are based upon data collected in the study area and from other studies. These recommendations are tentative and can serve as the basis for a long-term management plan. They should be reviewed continually and updated as additional information becomes available. It is imperative

that we begin management for preferred turkey habitat because of the accelerating pace of land and habitat modification.

Precommercial and Commercial Thinning

This timber management practice is extremely important, since treatment at this level affects present habitats and determines future conditions. If extensive areas are thinned to create even-age timber stands and promote optimum growth, the loss of dense cover would be detrimental to the overall turkey habitat, even though it may promote increases in ground vegetation (grasses and forbs). The overall goal for turkey habitat should be all of the following:

1. At least 20% of an area should be left in small, evenly distributed blocks (10+ acres) of saplings and poles with a basal area of 180+ sq. ft./acre. This provides escape cover and protection from storms.

2. At least 20% of an area should be in small, evenly distributed blocks (20-50 acres) composed of poles and intermediate trees, preferably of three age classes, with basal area of 120-180 sq. ft./acre.

3. The remaining 60% could be intensively managed for better growth.

Emphasis should be placed in the pine stands for these types of treatments. In areas of pine-oak, the oak provides density and a multistoried effect. In this way, turkeys have thick cover for escape and protection from the elements, uneven-aged stands for movement and feeding, and potential roost sites. Increased food availability is present in small, heavily treated stands which are used basically as small openings. The key is the distribution of horizontal and vertical diversity of the timber stands.

Around water sources, treatment should be designed to provide cover for "travel lanes" to and from water. Every effort should be made during treatment to allow screening cover from roads.

Edges of openings should have thick cover for escape. This cover need not be extensive in width; three or four chains would be sufficient.

Saw Timber

The removal of most mature or over-mature ponderosa has little effect on turkey habitat with the exception of

roost sites. The importance of roost sites and the following recommendations for roost site management were discussed by Phillips (1980). The basic recommendation is that a minimum of two good roost sites per section be left throughout the turkey range, with large sites (averaging 20 usable trees) on the winter range and smaller sites (averaging eight usable trees) on the summer range. In areas of winter range where only small clumps of suitable trees can be found for roost sites, it may be necessary to have three, four, or five sites per section to accommodate high densities of wintering turkeys. Most of the present roost sites on the study area are composed of old-aged trees. Some sites may not last long enough to be replaced by younger trees. However, in most areas there are enough intermediate age classes to provide future roost sites.

Since the intermediate age classes are harvested for saw timber, often to improve spacing and promote growth, it is necessary that potential roost sites with the proper basal area, aspect, and location be selected and protected for future replacement of the present sites.

Criteria for selection of potential roost sites are:

1. Site location--hillsides, benches, sides of canyons, and drainage bottoms are preferred locations.
2. Basal area--90-150 sq. ft./acre.
3. Aspect--eastern and northeastern aspects should be chosen whenever possible.
4. Summer range sites should be located within 1/2 mile of dependable water sources.

These sites could be best located and identified when marking intermediate stands for saw-timber harvest. The transition zone between ponderosa pine and pinyon-juniper is critical. Therefore, sites should be selected for allowing the growth of replacement roost trees in these areas.

Reforestation

It is important that all small openings (10-40 acres) within the turkey habitat, particularly on the summer range, be maintained. The partial reforestation of large openings may benefit turkeys.

Fuelwood Management

Increasing demand for fuelwood by the public will cause fuelwood management to become very important. Gambel

oak is important to turkeys, not only for food, but as cover, because it maintains multistoried stands.

It is recommended that oak fuelwood sales be directed towards:

1. Maintaining the viability of oak stands.

2. Cutting some areas in a manner that will increase mast production.

Fuelwood sales in the pinyon-juniper association within turkey range should be discouraged because of the value of the larger fruit-bearing trees. There are extensive stands of this association below the turkey range which can be used for fuelwood harvest.

Pinyon-Juniper Control

Scott (1975) found significant declines in turkey observations per distance traveled and total birds after pinyon-juniper control. He also found two intensively used year-long ponderosa pine roost sites abandoned after isolated treatment of pinyon-juniper. Ffolliott et al. (1977), on the Beaver Creek watersheds, found turkey use in cleared openings of one to nine acres in size was limited. Turkey use was higher in openings where slash was not burned.

Since pinyon-juniper produces food, cover, and protection from the elements, caution must be used when treating this type for range improvement projects. It is recommended that treatment areas be small in size (20 acres or less), narrow, not exceeding three to four chains in width, and that all junipers, 10 inches DBH or greater, be left. No pinyon should be removed because of its limited distribution. Care must be taken that no control is done in the vicinity of roost sites or around water sources. Extensive treatment of pinyon-juniper within turkey winter range should be discouraged.

Grazing

The current stocking rates and the routed, herding system used for sheep in the study area appears to be compatible with turkey habitat goals. Although cattle grazing has led to considerable habitat degradation in the past, cattle reductions coupled with a rest-rotation grazing system have resulted in habitat recovery. If present systems are carefully maintained, additional habitat improvements which favor wild turkeys should occur.

Disturbance and Roads

As more people visit national forests and summer and permanent home sites are constructed on private land within or in close proximity to turkey range, disturbance will continue to increase. The tendency to construct more and better roads encourages increased human use. Current road systems seem more than adequate, and the building of new roads and creation of additional access can only be detrimental to turkey populations.

Recreation

Care should be taken in recreational planning to limit the number of developed camp grounds and to insure that none are located in close proximity to primary water sources, small openings, or roost sites.

Private Land

The 6,860 acres of undeveloped private land within the study area should be purchased or acquired through land exchanges. Most of this acreage is in small tracts and generally in openings. These homestead openings are important and heavily used by turkeys.

I-40 Corridor

Since turkeys move across I-40 during seasonal migrations, it is imperative that proper habitat be maintained at crossings (Fig. 15). The Interstate poses no real barrier to turkeys, but, because of private land development and large openings, the areas where turkeys can cross are limited.

Nesting Habitat

A plan should be designed and implemented for improving nesting habitat and curtailing human activity in primary turkey breeding areas. These areas should be protected from disturbances (i.e., timber management and fuelwood cutting activities) from April 15 until July 1 to promote successful first nesting attempts.

Because slash is used for nesting, all new slash put on the ground prior to April 15 should be left in place until July 1. Nesting cover can be provided by leaving tree tops intact during saw timber harvests, and by making loose brush piles composed of two or three tops from pulpwood operations or from thinning activities, or by creating hinged trees where tops have a chance of remaining alive.

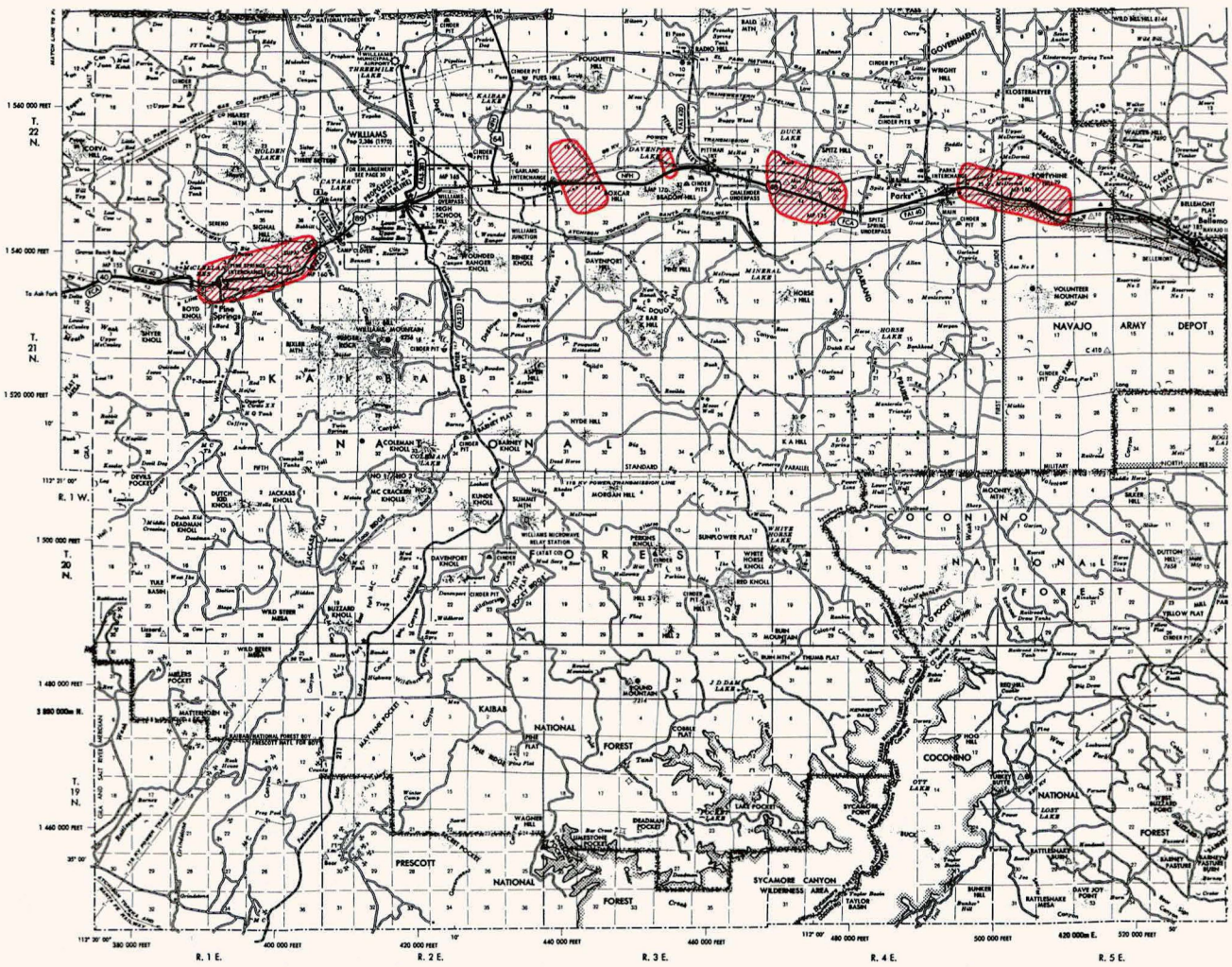

Fig. 15. Critical turkey crossing on I-40.

One to three such sites per acre should be sufficient. Emphasis should be placed in pine stands. Areas within pine-oak may already have enough cover in the form of shrubs or oak sprouts. Nesting cover should be created adjacent to a tree base, stump, or log with a canopy cover (60-80%) directly above the site. They should be located on eastern, northeastern, or northern slopes.

Water Development

There should be at least one dependable water source per section within the turkey range. Fig. 16 shows areas where water development is needed for turkeys. Earthen stock tanks are preferred by turkeys over water catchments. Recent decisions concerning water rights have created the necessity of developing water catchments. The large rainwater catchments now being used will generally produce more dependable water than earthen stock tanks.

Water should be made available for turkeys by developing fenced sites away from livestock troughs. Troughs or basins could be buried at ground level and connected to the main storage tank with a pipeline. Fencing would prevent damage by livestock. In all cases there should be cover leading to the water source, and if possible the water should be located at some distance from roads or at least screened by vegetation.

Hunting

Harvest Management

The goal for Arizona turkey hunting stated in the 1980-85 Big Game Strategic Game Plan is to "meet demand for fall turkey hunting, and maintain the quality of the spring hunt." Statewide, 1985, hunt objectives are:

1. To "maintain the existing hunter densities during the spring hunt."

2. "To allow up to 16,000 hunters to hunt turkeys in the fall before restricting use."

The goal for Wildlife Management Unit 8 is to provide as much hunting recreation as the turkey population will support during the fall hunt and to maintain the quality of the spring hunt.

The fall harvest in Unit 8, which averages 106 turkeys, could be increased without affecting the base population of adult hens. The unit can support an average of

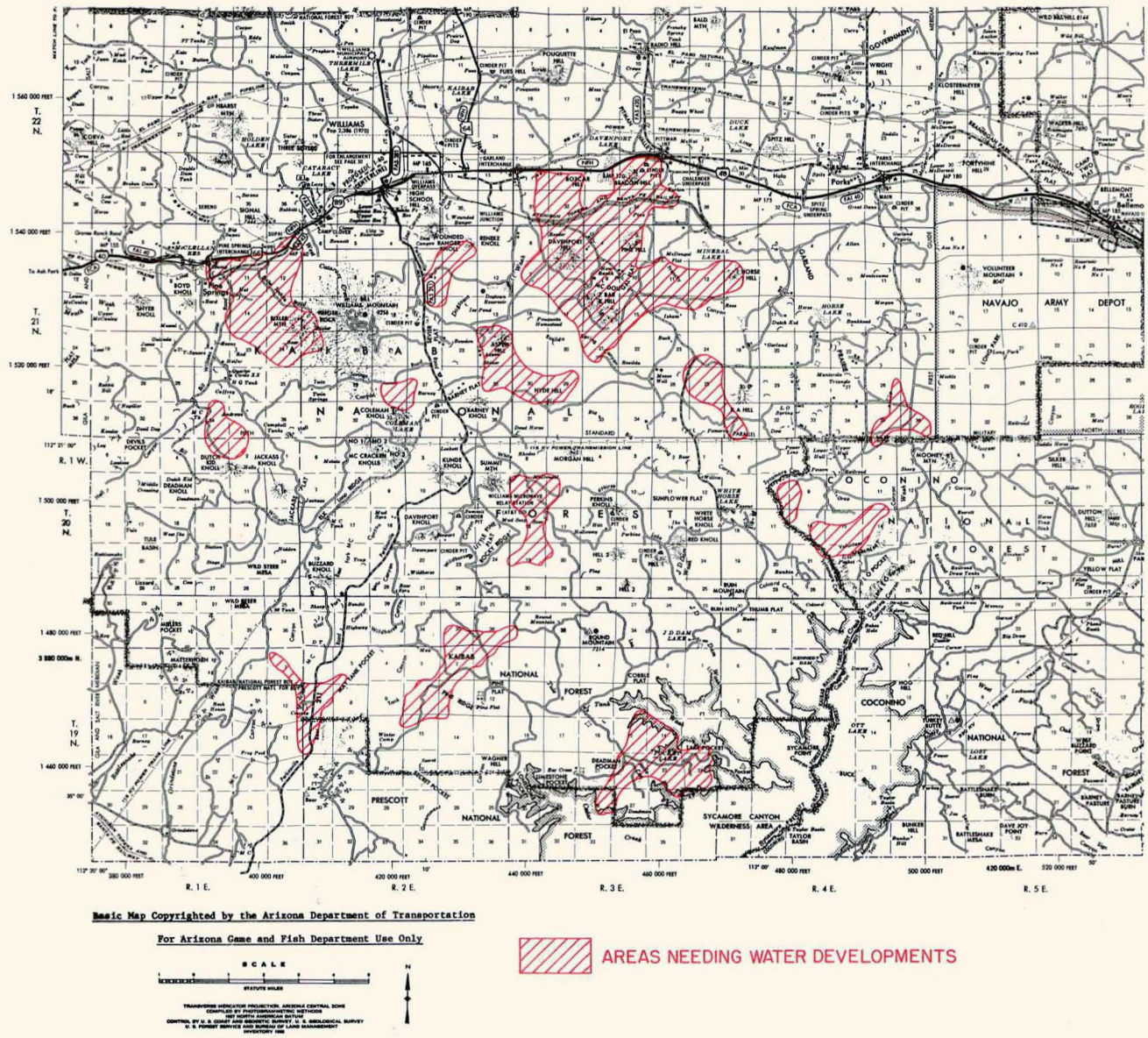

Fig. 16. Areas needing water development.

1,000 fall hunters before restrictive measures should be taken. This is an increase of 14.5% above the past 17 year average (873 hunters).

The author feels that an average spring harvest of 25 adult gobblers should not be exceeded. During the spring hunt, the density of hunters should not exceed one hunter per square mile in primary breeding range. This maintains quality hunting and affords the hunter a reasonable chance to call in a gobbler without interference from other hunters.

There are two basic alternatives, either of which would be suitable, for spring hunting:

1. To have one long season (not to exceed 31 days) with 200 permits. The number of permits would maintain the quality of the hunt with a density of one hunter/sq. mi., depending upon the number of permit holders who do not show up for the hunt.

2. To continue with two stratified seasons of 10 days with 200 permits each. This maintains the quality and desired harvest and allows more hunters to participate.

Needed Research

It is imperative that research define nesting and brooding habitat requirements within ponderosa pine associations.

It is also important that long-term research into the effects of different levels of timber management be implemented. This research should be a cooperative venture between the Arizona Game and Fish Department and the U.S. Forest Service. The current study area would be a good choice for these studies, because of its location on the periphery of the ponderosa pine, where optimum-growth and maximum-yield timber programs will alter the habitat more quickly than in the heart of the pines. Ultimately, it may be necessary to sacrifice a turkey population to convincingly demonstrate the effects of some types of timber management.

The effects of hunter density on the disruption of turkey flocks and mortality of poults should be another study.

An inventory technique with the objective of developing suitable criteria and methodology for computing the

size of the turkey population in Management Unit 8 should be initiated.

The effects of different levels of livestock grazing on turkey reproduction should be determined so that this important influence can be quantified.

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